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**United States Patent** [19]**Licht et al.**[11] **Patent Number:** **5,549,991**[45] **Date of Patent:** **Aug. 27, 1996**[54] **ALUMINUM PERMANGANATE BATTERY**[75] **Inventors:** **Stuart L. Licht**, Charlton City, Mass.;  
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Navy**, Washington, D.C.[21] **Appl. No.:** **168,788**[22] **Filed:** **Nov. 30, 1993**[51] **Int. Cl.<sup>6</sup>** ..... **H01M 4/58**[52] **U.S. Cl.** ..... **429/218; 429/188; 429/189**[58] **Field of Search** ..... **429/218, 188,  
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*Primary Examiner*—George Fourson*Assistant Examiner*—C. Everhart*Attorney, Agent, or Firm*—Michael J. McGowan; Prithvi C. Lall; Michael F. Oglo[57] **ABSTRACT**

A battery is provided comprising an aluminum anode, an aqueous solution of permanganate as the cathodic species and a second electrode capable of reducing permanganate. Such a battery system is characterized by its high energy density and low polarization losses when operating at high temperatures in a strong caustic electrolyte, i.e., high concentration of hydroxyl ions. A variety of anode and electrocatalyst materials are suitable for the efficient oxidation-reduction process and are elucidated.

**28 Claims, 4 Drawing Sheets**